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CLINICAL AND EXPERIMENTAL INVESTIGATIONS WITH SERNYL AND COMBELEN FOR IMMOBILIZATION OF RUMINANTS

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Translation of "Klinische und Experimentelle Untersuchungen mit Sernyl Combelen zur Wiederkäuerimmobilisation," Archiv fuer Experimentelli Veterinaermedizin, Vol. 25, 1971, pp 847-852

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16. Abstract

By using a combination of Sernyl (phencyclidine) and Combelen (propionylpromazine), 86 ruminants belonging to 23 species and subspecies were immobilized. 62 of the animals were in Berlin Zoo and the remainder in various game reserves. The onset of immobilization after injection of 0.5-4.0 Sernyl and 0.01-0.13 ml Combelen solution per kg body weight varied in different species from 5 to 100 minutes (average 7-12) after injection and it lasted for 10-240 minutes. Fallow deer required a much higher dosage than the other Cervidae. As a rule, high dosage produced longer and deeper "anesthesia". Experiments on five domestic sheep and four goats showed that 5 or 6 times the normal dosage was well tolerated. A toxic effect was not seen until ten times the normal dosage (10 mg Sernyl + 0.1 ml Combelen solution) was given — 3 of 7 animals died. Two of those that died developed hyperthermia (41°C).

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CLINICAL AND EXPERIMENTAL INVESTIGATIONS WITH SERNYL[1] AND COMBELEN FOR IMMOBILIZATION OF RUMINANTS

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Immobilization of animals has come increasingly into the foreground of /847* veterinary care of wild animals in zoos, large enclosures, and free game preserves. Catching the animal by force and coercive methods such as ropes, planks and so forth can lead to excitement threatening the life of the animal, and fatal shock. In such cases the regulatory center of the autonomic nervous system in the brain stem, especially in the formatio reticularis, is no longer able to maintain homeostasis between the vagus and sympathetic nerves (Westhues, 1960). The danger of injuries, bone fractures, and fatal shock caused by fear and panic upon capture is especially great in wild ruminants (Kuntze, 1962). Continuous alertness and readiness to take flight is a condition of survival for the wild animal (Hediger, 1959).

Both fear and the use of force can be avoided by the use of sedatives and relaxants. Careful investigations and necessary surgical operations become possible and are easier. In the past few years, a large number of single and combination drugs have been investigated for their applicability to the immobilization of large wild animals (Buechner, Haathoorn, and Lock, 1960 a, b, c, d, e). Niekerk, Pienaars, and Fairall (1963) reported the application of 15 drugs from widely-varying chemical substances for catching wild animals in Kruger National Park. The requirements for immobilizing drugs in veterinary practice in the zoo were summarized by Kuntze (1967). They should:

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[1]The preparation Parke-Sernyl was imported to the GDR for the use of the Zoological Garden from the DHZ Pharmacy (Veterinary Imports).

[2]Portions taken from the Dissertation by S. Jancke, to be published.

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*Numbers in the margin indicate pagination in the foreign text.

- be applied intramuscularly (i.m.) without side effects,

- have a broad therapeutic range,

- be easily reversible,

- have no harmful side effects, and

- be as rapid as possible in their action.

In addition, in order to be used with the Cap-Chur tranquilizer gun, they must be effective in small quantities. None of the preparations known to date matches this ideal.

Pharmacology

Sernyl (phencyclidine = 1-(1-phencyclohexyl) piperidine hydrochloride) is relatively successful in application. /848 It affects the central nervous system by stimulation or depression according to the species of animal and the dosage. The exact sites of action are not known. The peripheral autonomic nervous system is not affected by Sernyl. It has no antiadrenergic, ganglia-blocking, anticholinergic, or antihistaminic effects (Faustmann, 1965). According to Harthoorn (1963a), with a small dose the animals' eyes remain open with dilated pupils. They react sluggishly to light. There is slight muscular paralysis, especially in the front extremities and the neck. At medium dosages a cataleptic state is reached, and at higher dosages a state similar to anesthesia. At still higher doses there is a transition to a state which allows surgery. Sernyl's local anesthetic effect is about half that of cocaine or twice that of procaine. Corneal, pupillary, and patellar reflexes are not impaired (Kroll, 1962); Harthoorn (1963b), when using a combination of Sernyl, Thermalon (a synthetic morphine derivative) and scopolamine, observed a catatonic trance state with large wild animals who moved as if under hypnosis and were undisturbed by events that would normally cause fright and fear.

The effects according to the various species of animal have already been reported (Kuntze, 1967).

Authors' Investigations

Clinical Material

In our investigations, conducted between September 1966 and September, 1968 on wild and zoo ruminants (86 in all), we used Sernyl in combination with Combelen and partly with Quiloflex, a benzodioxane derivative with sedative and muscle-relaxing effects. In five cases narcosis followed, induced by chloral hydrate. /849

TABLE 1. EXPERIMENTS WITH SERNYL-COMBELEN (QUILOFLEX) ON WILD RUMINANTS

Species (Number)	Weight[1] kg	Dosage S mg	Dosage Q mg	C ml	Uncertainty Minutes P. Inj.	Lying Down Minutes P. Inj. From	Lying Down Minutes P. Inj. To
Axis deer (1)	60	100	100	2.0	7	100	240
Barasingh (swamp) deer (1)	110	100	-	1.0	7	11	45
Bokhara deer (1)	80	80	-	1.4	9	11	n.n.
Fallow deer (3)	20	80	80	2.6	2	7	10-120
Fallow deer (2)	20	70-100	-	1.0-1.3	4-11	12-16	n.n.
Fallow deer (7)	45-55	80-150	50-125	1.0-2.6	5-8	8-28	30-50
Fallow deer (3)	40-50	130	-	0.7-2.2	4-5	8-20	33-58
Elk (1)	250	250	100	3.5	n.n.	Total	60
Elk (3)	350	350-400	-	3.0-4.0	9-12	6-12	47-52
Elk, antelope (1)	82	100	100	2.0	3	10	37
Deer, goat, antelope (1)	15	15	15	0.3	2	5	n.n.
Deer, goat, antelope (1)	30	30	-	0.6	n.n.	7	240
Milu (1)	200	100	100	2.0	5	12	150
Mouflon (1)	18	70	-	1.3	4	6	n.n.
Mouflon (1)	25	80	80	2.6	n.n.	8	n.n.
Mouflon (1)	50	105	50	2.0	n.n.	5	144
Red deer (1)	60	80	80	2.6	3	9	n.n.
Red deer (1)	100	80	75	1.0	2	7	>45
Red deer (2)	200	100-200	50-100	2.0-7.0	3	9-10	>40-60

TABLE 1 (CONTINUED)

Species (Number)	Weight[1] kg	Dosage S mg	Dosage Q mg	C ml	Uncertainty Minutes P. Inj.	Lying Down Minutes P. Inj. From	Lying Down Minutes P. Inj. To
Siberian reindeer (1)	12	10	-	0.2	n.n.	5	103
Wapiti (1)	180	100	100	2.0	3	11	51
European bison (2)	300	250-270	-	25.-2.7	4-7	8	40-45
European bison (1)	300	400	-	4.0	3	7	180
European bison (3)	450-500	350-450	-	3.5-4.0	8	12-15	52-69

[1]Weight of animals usually estimated.
Expansions: S = Sernyl; Q = Quiloflex; C = Combelen; n.n. = not noted.

Forty-one cases, in which one injection immobilized the animal, are shown in Table 1. It emerges from this that, independently of the animal species and of whether Quiloflex was present in the mixture, after 2-12 minutes the first signs of uncertainty appeared, made noticeably by standing still, slight ataxia and, in some cases, salivation and separation from the herd. The animals were immobilized 5-28 minutes (in one axis deer, not until 100 minutes) post injectionem (p. inj.) for a duration of 30 minutes to 4 hours; here the relationships between the dosage and the time were not always clear. Three young fallow deer, each with an estimated body weight of 20 kg, received 80 mg Sernyl, 80 mg Quiloflex, and 2.6 ml Combelen. One of them lay still, from 7 minutes p. inj. for over 2 hours, the second also lay down after 7 minutes but was able to stand up again 10 minutes later, while the third could only be caught, and then with some difficulty, after 20 minutes. In the traveling box, he assumed a prone position for 10 minutes, then stood up again 10 minutes later when the second animal was introduced into the box.

With two European bison, on the other hand, the period of effectiveness clearly increased with the dosage. Both animals weighed about 300 kg. The first received 250 mg Sernyl and 2.7 ml Combelen. Seven minutes p. inj. it was

possible to start handling him, without waiting for full immobilization. After 45 minutes the animal stood up again. The second European bison received 400 mg Sernyl and 4.0 ml Combelen, also i.m., via the Cap-Chur Gun. The first signs of drug action were observed after three minutes. After a further 4 minutes the animal lay still for three hours.

In 12 animals not caused to lie down by the first injection, immobilization had nevertheless progressed to the point that, depending on the reason for treatment, one antler amputation, two hoof treatments and, in the remaining nine cases, introduction of the animals into a traveling box, took place with no danger to either man or beast.

In about 25% of the cases the first injection was not sufficient to allow the animals to be handled. A second injection was given and, in one case, a third. Such incidents could be traced to the dart immediately bouncing or gliding off, and to individual differences in tolerating the drug.

A male fallow deer with a body weight of about 50 kg showed the first signs of uncertainty five minutes after application of 130 mg Sernyl and 2.2 ml Combelen, and lay down after 20 minutes, getting up again 25 minutes later. Another male fallow deer with a body weight of about 55 kg, on the other hand, received 150 mg Sernyl and 1.6 ml Combelen. After 21 minutes there were no detectable symptoms. The animal was given another 50 mg Sernyl and 1.5 ml Combelen which led to only a slight degree of uncertainty after eight minutes, which was not sufficient to allow the animal to be captured. Fifty minutes after the second injection another 100 mg Sernyl and 2.0 ml Combelen were administered. Five minutes later the animal had a high degree of ataxia; it could be captured, and the stakes could be removed. Half an hour after the third injection it began trying to get up.

Altogether 23 animals were captured for traveling. They lived principally in a spacious wild animal enclosure. Five animals were immobilized for hoof care and 17 for antler amputation. In the remaining cases, they had to be immobilized because of injuries (nine fractures to extremities or hoof injuries, four horn injuries, four antler injuries, and others) or suspicion of disease (e.g., five suspected piroplasmoses in European bison). All the animals recovered from this drug-induced immobilization.

Experimental Material

Experimental investigations were also conducted on five male domestic sheep and one male and three female domestic goats, destined for slaughter. /850

As seen from Table 2 40 tests were made with doses of 0;6 mg Sernyl and 0.012 ml Combelen/kg body weight up to 10.0 mg Sernyl and 0.1 ml Combelen/kg body weight. At the highest dose two of the seven animals died during the experiment, and one died three days later from acute respiratory pneumonia.

TABLE 2. INVESTIGATIONS WITH SERNYL-COMBELEN ON DOMESTIC SHEEP AND GOATS

Test (Number)	Dosage/kg Body Weight		Lying Down P. Inj. (Minutes)		Time Prone (Hours)	
	S (mg)	C (ml)	Minimum	Maximum	Minimum	Maximum
I (4)	0.6	0.012	5	20	-	1
II (4)	0.7	0.014	7	36	-	1 1/2
III (8)	0.8	0.016	4	13	-	2 1/2
IV (8)	1.0	0.020	5	27	3/4	2 3/4
V (3)	1.6	0.032	4	30	3	5
VI (3)	2.4	0.048	3	9	3 1/2	5 1/2
VII (1)	4.0	0.080	3		7	
VIII (1)	5.0	0.100	3		18	
IX (1)	6.0	0.120	2		23	
X (7)	10.0	0.100	1	7	23	48[1]

[1]Two of the seven animals died during the experiment.
Expansions: S = Sernyl; C = Combelen.

The first effect noted was the salivation of the animals. Shortly thereafter there was motor restlessness — the animals tripped about. A few minutes later they took up the abdominal position. In Tests I, II, and III four animals in all were restless for a longer time (1.0-1.5 hours) and did not lie down. It is noteworthy that two goats, which could not stand for longer than half an hour in Test I, did not lie down in Test III. This cannot be explained by their becoming accustomed to the drug, a slightly increased dose fully immobilized them for 1-2 hours.

The experimental animals lay down, independently of the dosage, between three and 36 minutes p. inj. Even with an overdose as in Test X, this phase

lasted up to seven minutes, while three animals in this group lay down after only 1-2 minutes.

The apical heartbeat was auscultated at the thorax to ascertain the cardiac action. Both tachycardia and bradycardia occurred. The changes in frequency were not dosage-dependent and did not show a clear trend.

The body temperatures were between 38.4 and 40.3°C. During the tests there were temperature variations of up to 4.4°C. Extreme values were found between one and six hours p. inj. There were a total of 16 temperature rises and 21 temperature drops. One striking fact was that with the higher doses (Tests VII to X) the temperature always dropped. Only in the two animals which died in Test X did temperatures up to 40.8°C (20 minutes before death) and 42.1°C (death the next day) develop.

Rumen motoricity was always impaired. Except for one animal in Test II, the rhythm slowed down or rumen contractions ceased altogether. In Tests VI-X, /851 rumen movements stopped in every case 10-20 minutes p. inj. This condition lasted for several hours and caused the animals to swell. In such cases it is advantageous to raise the head of the animal somewhat, but this was deliberately dispensed with in our experimental investigations.

The investigations show that even with strong overdoses no real damage is done. Of course, the immobilized animal must be carefully monitored in such cases. This is recommended in particular to prevent tympanitis and the consequences of regurgitating the contents of the first stomach.

At cool ambient temperatures hypothermia and its possible effects on the organism must be considered. Basically, our experimental investigations show in particular that the Sernyl-Combelen combination is suitable for immobilizing wild ruminants.

REFERENCES

Buechner, H. K., A. M. Harthoorn and J. A. Lock, "Control of African Wild Animals, *Nature*, Vol. 185, pp. 47-48, 1960a.

Buechner, H. K., A. M. Harthoorn and J. A. Lock, "The Immobilization of African Animals in the Field, with Special Reference to Their Transfer to Other Areas (U. S. Translocation)," *Proc. Zool. Soc.*, Vol. 135, London, pp. 261--264, 1960b.

Buechner, H. K., A. M. Harthoorn and J. A. Lock, "Immobilizing Uganda Kob with Succinylcholine Chloride," *Canad. J. Comp. Med. Vet. Sci.*, Vol. 24, pp. 317--324, 1960c.

Buechner, H. K., A. M. Harthoorn and J. A. Lock, "Recent Advantages in Field Immobilization of Large Animals with Drugs," *Transact. 25th. North Am. Wildl. Conf.*, pp. 415-422, 1960d.

Buechner, H. K., A. M. Harthoorn and J. A. Lock, "The Immobilization of Wild Animals as an Aid to Management and Control," *J. Fauna Pres. Soc. (Oryx)*, Vol. 4, pp. 346-351, 1960e.

Faustmann, D., "The Usefulness of Sernyl in Domestic Animals," *Dissertation*, Munich, 1965.

Harthoorn, A. M., "Modern Trends in Animal Health and Husbandry Ataractic, Hypnotic and Narcotic Mixtures for the Capture and Handling of Large Wild Animals," *Brit. Vet. J.*, Vol. 119, pp. 47-63, 1963a.

Harthoorn, A. M., "Techniques of Handling Large Animals Such as Elephant, Rhinoceros and Hippopotamus, Etc. by Use of Drugs," *Kongressbericht* 17, World Veterinary Congress, Hannover, 183-187.

Hediger, H., "Fear in the Animal," *Universitas*, Vol. 14, pp. 929-937, 1959.

Kroll, W. R., "Experience with Sernylan in Zoo Animals," *Internat. Zoo Yearbook*, Vol. 4, pp. 131-141, 1962.

Kuntze, A., "Surgery in Wild Ruminants with Special Attention to Elimination of Pain," *Nord. Vet. Med.*, Vol. 14, Suppl. 1, pp. 63-71, 1962.

Ibid., "Indication and Limits of Drug-Induced Immobilization (Narcosis, Neuroplegia, Muscle Relaxation) in Zoo Animals," *Report of the Ninth Internt. Symp. on Diseases in Zoo Animals*, Prague, 1967.

Niekerk, V. J. W., U. Piernaar and N. Fairall, "Immobilizing Drugs Used in the Capture of Wild Animals in the Krueger National Park," *J. S. Afr. Vet. Med. Ass.*, Vol. 34, pp. 403-411, 1963.

Westhues, M., "Sedatives and Relaxants," *Berl. Munch. Tierarztl. Wschr.*, Vol. 73, pp. 463-465, 1960.

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